

Application Number 10/789322
Response to Office Action dated 11/07/2008

REMARKS

Applicant respectfully request favorable reexamination and reconsideration of this application.

Claim 19 has been revised. The revision is supported by, for example, Figs. 3-5 and page 18, lines 16-29 in the Specification. There is no new matter.

Claims 1, 3-17, 19, and 21-22 are pending, of which claims 10-17, 21, and 22 are withdrawn from consideration.

Examiner Interview

Applicants thank the Examiner, Weiping Zhu, for the telephonic interview held on February 19, 2009 regarding the above-referenced application. At the interview, JP 61-1292246 and Tomioka et al. (US 3532560) were discussed relative to claim 1. No agreement was reached at the conclusion of the interview.

Claim Rejections - 35 U.S.C. § 103

Claims 1 and 3 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 61-1292246 (hereafter JP'246) in view of Tomioka et al. (US 3532560). Applicants respectfully traverse this rejection.

The rejection conceded that JP'246 does not disclose the drawing ratio as claimed. The rejection stated that Tomioka et al. satisfies this deficiency. Applicants respectfully disagree.

The rejection relied on an erroneous assumption. The assumption is that all processes that are applicable to medium carbon steel are combinable. Tomioka et al. itself directly contradicts this assumption. Tomioka et al. teaches that "the novel process of our invention makes it possible to obtain uniform fine grain sorbite structures for steel wires and this process can be clearly distinguished [from other processes]" (column 2, lines 69-72). Tomioka et al. teaches that this "novel process" includes stretching tempered steel wire to less than 20% reduction in area to obtain a steel wire of uniform fine grain sorbite structure (see column 7, lines 62-70). Further, Tomioka et al. teaches that "a coarse grain sorbite structure" is undesirable and further that "a pearlite structure" is also undesirable (column 7, lines 32-37). In particular, Tomioka et al. teaches that a pearlite structure is undesirable because it reduces tensile strength of the steel wire (see column 7, lines 35-37). It is well known in the art that sorbite is an

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intermediate structure between hardened steel (troostite) and annealed steel (pearlite). It is further known in the art that sorbite is considered to be a very good structure for medium and high-carbon steel used for stress-carrying parts of machines. In contrast, it is also known that pearlite is an eutectoid of steel, and further that, ferrite is a structure having pure iron. Accordingly, it is known in the art that crystalline grains of pearlite have different microstructure from sorbite. Accordingly, Tomioka et al. teaches that a process used to obtain a particular microstructure is distinguishable from other processes, even if they are used in steel having the same or similar hardness. Thus, Tomioka et al. directly traverses the fundamental presumption relied in the rejection.

Further, the rejection stated that “the drawing ratio is obviously a result-effective variable, because it would direct [sic] affect the diameter and tensile strength of the wire...it would have been obvious to one of ordinary skill in the art to have optimized the drawing ratio in the process of JP ('246) in order to achieve desired diameter and tensile strength of the material” (Office Action, page 4). Applicants respectfully disagree.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984); also see *MPEP 2141.02, VI*. Accordingly, Tomioka et al. must be considered in its entirety, including the portions that teach away from the claim.

Tomioka et al. teaches that the workabilities for cold-forging are not necessarily affected by the material's tensile strength (see column 4, lines 49-56). Tomioka et al. teaches that the “workabilities of materials to be cold-shaped” has “almost nothing to do with the degree of hardness of the particular steel wire to be cold-shaped, but rather greatly depends upon the mechanical properties of the particular steel wire employed, especially the ... microstructure of the steel wire” (column 3, lines 19-26). Accordingly, Tomioka et al. teaches that there is a relationship “between microstructures of various types of steel wires ... and reductions of area” (column 4, lines 59-66, also see Figs. 2-3 wherein Tomioka et al. teaches that there is a relationship between the reduction of area % to cracking % in cold press in Fig. 2 and further the reduction of area % to breaking % in cold press in Fig. 3). Accordingly, Tomioka et al. teaches that tensile strength and hardness of steel is not directly correlated to reduction in area and/or workability for cold-shaping. Rather, Tomioka et al. teaches that the workability of steel for

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cold-shaping is the result of the microstructure of the steel, and that there is a correlation of reduction % of steel to its microstructure. Thus, Tomioka et al. does not teach that the drawing ratio is a result-effective variable that directly affects the tensile strength of the wire.

Tomioka et al. teaches that the step of stretching of the wire by “usually about 13%” is applied to the tempered steel wire “having a uniform fine grain sorbite structure and a tensile strength of 70-120 kg./mm.²” to obtain a “tempered steel wire of uniform fine grain sorbite structure” that is “continuously cold-forged” (column 7, lines 51-67). Thus, the reduction in the area of the wire that is formed to about 13% is performed on an alloy that does not have a pearlite microstructure, to obtain a tempered steel wire of uniform fine grain sorbite structure for continuous cold-forging. In contrast, claim 1 requires a drawing of a blank at a drawing ratio of approximately 20%, wherein the blank comprises pearlite. Accordingly, Tomioka et al. applies a step of stretching of the wire by “usually about 13%” to a different type of blank than is being claimed.

Further, Tomioka et al. applies the step to a material that is different than that in JP'246. In JP'246, a drawing step is applied to a soft annealed material. In contrast, Tomioka et al. teaches that the drawing ratio of “about 13%” is applied to a steel wire with a sorbite structure. The drawing ratio according to Tomioka et al. is applied to a tempered and quenched material to obtain a tempered steel wire of uniform fine grain sorbite structure (column 7, lines 8-65). A quenched and tempered material having a sorbite structure has a high hardness. Accordingly, the drawing step in Tomioka et al. is performed on a substantially different material than the soft material taught in JP'246. Thus, the drawing step in Tomioka et al. is performed to achieve a different result than the drawing step in JP'246. Therefore, there is no motivation to combine the “less than 20%” drawing ratio taught in Tomioka et al. that is applied to obtain a uniform fine grain sorbite structure on a hardened material, with a drawing step taught in JP'246 that is applied to a softened annealed material.

Further, the rejection erroneously concluded that Tomioka et al. teaches that “only a coarse grain pearlite structure are undesirable” (Office Action, page 5). A careful reading of Tomioka et al. makes it readily understandable that the adjective “coarse grain” modifies only the noun “sorbite” and does not modify the noun “pearlite.” The particular sentence in question separates “a coarse grain sorbite structure” and “a pearlite structure” with an “or” indicating clearly that the two structures are separate and distinct. Further, Tomioka et al. teaches that a

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pearlite structure is not desirable because such a structure reduces the tensile strength of the steel wire. Accordingly, albeit their proximity in the order of the words in the sentence, applying the adjective that modifies "sorbite structure" to modify the noun "pearlite structure" does not lead to the correct understanding of the teaching in Tomioka et al. Further, if Tomioka et al. wanted to teach that the undesirable structure were only "a coarse pearlite structure," as purported in the rejection, Tomioka et al. could have instead stated *a coarse grain sorbite structure or a coarse grain pearlite structure*, or alternatively, *a coarse grain sorbite or pearlite structures*. Neither of which, Tomioka et al. did or does. Instead, Tomioka et al. teaches that while a fine grain sorbite structure is desirable, a coarse grain sorbite structure is not desirable. Further, Tomioka et al. teaches that a pearlite structure (not only one of coarse grain) which reduces the tensile strength of the steel wire is undesirable. Thus, contrary to the erroneous conclusion stated in the rejection, Tomioka et al. does not teach that only a coarse pearlite structure is undesirable.

Accordingly, one of ordinary skill in the art would not consider a step of stretching tempered steel wire to obtain a steel wire of uniform fine grain sorbite structure and to avoid having a pearlite structure to be identical to a step of drawing a blank comprising ferrite and pearlite, wherein the pearlite is spheroidized. Because the claims and Tomioka et al. have substantially different microstructures, a feature which Tomioka et al. states is of paramount importance and determinative in the differences of steel wires, *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977) is not applicable.

Accordingly, Tomioka et al. teaches that microstructure of the steel wire is more important than degree of hardness of the particular steel wire to be cold-shaped. Further, Tomioka et al. teaches that the microstructure of a fine grain of sorbite structure is the key to Tomioka et al.'s process. As a part of this process to obtain a fine grain sorbite structure, Tomioka et al. teaches the step of drawing a wire to less than 20% reduction in area. Thus, the stretching step of Tomioka et al. is for the purpose of obtaining a fine grain sorbite structure for continuous cold forging. Further, Tomioka et al. does not teach or even suggest steel having spheroidized pearlite. In fact, Tomioka et al. expressly teaches away from steel having a pearlite structure. Thus, there is no motivation to combine the teachings in Tomioka et al. with JP'246. Further, there is no evidence that the drawing a wire to less than 20% reduction in area is a result-effective variable for a blank comprising pearlite. Thus, concluding the JP'246 in view of Tomioka et al. teaches the claimed features of claim 1 requires impermissible hindsight.

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For at least the above reasons, claim 1 is patentable over JP'246 in view of Tomioka et al. Claim 3 is also patentable for at least the same reason as claim 1 from which it depends. Applicants respectfully request a favorable reconsideration of the claims.

Claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over JP'246 in view of Tomioka et al. and further in view of JP 07-097656 (hereafter JP'656). Applicants respectfully traverse this rejection. JP'656 does not remedy the deficiencies of Tomioka et al. and JP'246 stated above. Accordingly, claim 4 should be allowed for at least the same reasons as claim 1 from which it depends. Applicants respectfully request a favorable reconsideration.

Claims 5 and 9 were rejected under 35 USC 103(a) as being unpatentable over JP'246 in view of Tomioka et al. and further in view of Bach et al. (US 4704166). Applicants respectfully traverse this rejection. Bach et al. does not remedy the deficiencies of Tomioka et al. and JP'246 stated above. Further, none of the references teach or suggest forming an intermediate layer comprising martensite, ferrite, and pearlite formed radially inwardly on the surface, and a central region comprising a mixed phase of ferrite and pearlite, and then annealing the blank to convert the martensitic structure of the surface and the intermediate layer into a fine spheroidized structure comprising ferrite and cementite, and breaking the pearlite of the intermediate layer and the central region. Further, none of the references teach or suggest obtaining the surface with the fine spheroidized structure comprising ferrite and cementite, the intermediate layer comprising a mixed structure of the broken pearlite and the fine spheroidized structure comprising ferrite and cementite, and the central region comprising broken pearlite. Claim 5 is patentable over JP'246 in view of Tomioka et al. and further in view of Bach et al. Claim 9 is also patentable for at least the same reasons as claim 5 from which it depends. Applicants respectfully request a favorable reconsideration of the claims.

Claims 6-8 were rejected under 35 USC 103(a) as being unpatentable over JP'246 in view of Tomioka et al. and further in view of Bach et al. and further in view of JP'656. JP'656 does not remedy the deficiencies of Bach et al., Tomioka et al., and JP'246 stated above. Accordingly, claims 6-8 should be allowed for at least the same reasons as claim 5 from which they depend.

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Further, claim 6 requires annealing the blank by holding the blank at about 740 °C. Claim 7 requires annealing the blank by holding the blank at about 750 °C for 4 hours, then at about 735 °C for 3.5 hours. Accordingly, both claims 6 and 7 require temperatures that are specifically taught in Tomioka et al. as undesirable. Thus, even if JP'656 discloses annealing temperature of 730 °C, which Applicants are not conceding, there is no motivation to combine the reference with the teachings of Tomioka et al. which specifically teaches that such temperature is undesirable.

The rejection stated that the required tempering temperature above 700 °C relies on JP'656 and not Tomioka et al. However, the rejection is still combining the teachings of Tomioka et al. which teaches that the microstructure of the steel is more important than the hardness of the steel and further that tempering temperature above 700 °C as undesirable because "if the tempering heating temperature is in excess of 700 °C., the decomposition of the martensite structure of the steel wire into the sorbite structure is too rapid, resulting in a coarse grain sorbite structure or a pearlite structure which reduces the tensile strength of the steel wire ... therefore, a tempering heating temperature in excess of 700 °C is objectionable where it is desired to produce a tempered steel suitable for producing a cold-forged product" (column 7, lines 32-39). This teaching is not a mere embodiment but a requirement in achieving the necessary fine grain sorbite structure that Tomioka et al. considers to be their invention.

Thus, there is no motivation to combine the reference with the teachings of Tomioka et al. which specifically teaches that such temperature is undesirable. Further, because Tomioka et al. specifically teaches away from the claimed temperatures, the claimed features are not discovering an optimum values involving only routine skill in the art. Claims 6-8 are patentable over JP'246 in view of Tomioka et al. and further in view of Bach et al. and further in view of JP'656. Applicants respectfully request a favorable reconsideration.

Claim 19 was rejected under 35 USC 103(a) as being unpatentable over JP'246 in view of Tomioka et al. and further in view of JP'656 and Sakai et al. Applicants respectfully disagree that the references teach or suggest all of the features of claim 19. Claim 19 requires carbon steel that includes a ferrite and a pearlite, and spheroidizing the pearlite. Claim 19 is not obvious in view of JP'246 and Tomioka et al. as discussed above in regard to claim 1, which also requires ferrite and pearlite, wherein the pearlite is spheroidized. Neither JP'656 nor Sakai et al. remedy

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the deficiencies of JP'246 and Tomioka et al. For at least this reason, claim 19 is patentable over JP'246 in view of Tomioka et al. and further in view of JP'656 and Sakai et al. Applicants respectfully request a favorable reexamination and reconsideration of the claim.

In view of the above amendments and remarks, Applicants respectfully request a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned attorney-of record, Curtis B. Hamre (Reg. No. 29,165), at (612) 455-3802.

Respectfully submitted,



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